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## Understanding Racial Differences in Health-Related Quality of Life in a Population-Based Cohort of Breast Cancer Survivors

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### Abstract

**Purpose**—Although racial disparities in health-related quality of life (HRQOL) among women with breast cancer (BC) are well documented, less is known about HRQOL changes over time among women of different races. Our objective was to assess racial differences in HRQOL during active treatment and survivorship phases of BC care.

**Methods**—We used data from the third phase of the Carolina Breast Cancer Study (CBCS-III). CBCS-III enrolled 3,000 women in North Carolina aged 20–74 years diagnosed with BC between 2008 and 2013. HRQOL assessments occurred 5- and 25-months post-diagnosis, representing distinct phases of care. HRQOL measures included the Functional Assessment of Cancer Therapy for BC and Functional Assessment of Chronic Illness Therapy for Spiritual Well-Being. Analysis of covariance models were employed to assess racial differences in changes in HRQOL.

**Results**—The cohort included 2,142 Non-Hispanic White (n=1,105) and Black women (n=1,037) who completed both HRQOL assessments. During active treatment, Whites reported physical and functional scores 2–2.5 points higher than Blacks (p<0.0001). Spiritual HRQOL was 2.1 points higher for Blacks (p<0.0001). During survivorship, differences persisted. After adjusting for demographic, socioeconomic, tumor and treatment characteristics, physical and functional HRQOL gaps narrowed, but spiritual HRQOL gaps widened.

**Conclusions**—Racial differences in physical and functional HRQOL during active treatment and survivorship may be largely mediated by socioeconomic factors. However, our results suggest that among Black women, spiritual HRQOL is well supported throughout the BC care continuum.

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Compliance with Ethical Standards:

**Conflict of Interest:** Authors Dr. Samuel and Dr. Wheeler have received a research grant from Pfizer for another unrelated study. All other authors (Ms. Pinheiro, Dr. Reeder-Hayes, Dr. Olshan and Dr. Reeve) declare that they have no conflicts of interest to disclose. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

These results inform opportunities for improving the quality and equity of supportive services for women with BC.

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## Introduction

Over 3 million women in the United States (U.S) are currently living with breast cancer (BC) or have a history of BC [1]. Given that 5- and 10-year BC survival rates are 90% and 80%, respectively, most women diagnosed with BC become long-term survivors [2]. As the number of women surviving BC grows, monitoring and characterizing changes in health-related quality of life (HRQOL), as well as identifying women at high-risk for long-term HRQOL deterioration during survivorship, is critical to ensuring patient-centered care across the BC care continuum.

Thirty percent of women experience poor psychosocial and physical HRQOL before, during, and after treatments [3,4]. Women with BC report greater levels of treatment-related symptoms compared to similarly aged healthy women [5-7]. Studies have shown BC is a risk factor for poor mental health, and rates of depression are twice as high among adults with cancer than those without cancer [7,8].

BC risk and burden varies systemically between Black and White women [9]. Although BC incidence rates do not differ significantly between Black and Whites, Blacks are more likely to die from BC [2]. Black women are more likely to be diagnosed at younger ages with more aggressive tumors [10]. As Blacks are over-represented in lower socioeconomic groups, they may be more likely to experience diagnosis and treatment delays associated with worse survival [11] [12].

Racial gaps in HRQOL are well-documented in BC, but differences are not uniform across ages or HRQOL domains [3,13-17]. Specifically, compared with their White counterparts, Black women with BC report worse physical and functional HRQOL [17,18]. However, this may not be the case at different phases of BC care. A retrospective Medicare study found that while racial disparities in HRQOL were prevalent before cancer diagnosis, gaps in certain domains narrowed following exposure to the cancer care system [15]. Once Black women are diagnosed with BC and engage with the health care system, Black-White differences may narrow because previously unaddressed needs are met, which positively impacts HRQOL [15].

To our knowledge, no study has assessed racial disparities in changes in individual HRQOL domains over time in a large, multi-payer, population-based cohort. Our objective was to determine whether or not HRQOL varied between White and Black women during active treatment, survivorship, and in changes between these two time points. To do this, racial differences in six HRQOL domains (i.e., physical, social, emotional, functional, and spiritual well-being, and BC-specific concerns) were examined between 5- and 25-months after diagnosis among Black and White women with BC in North Carolina.

## Methods

### Data

Data for this study came from the third phase of the Carolina Breast Cancer Study (CBCS-III). CBCS-III enrolled 3,000 women diagnosed with incident, invasive, pathologically confirmed BC between 2008 and 2013. Participants spanned 44 counties in North Carolina and were identified using rapid case ascertainment [12]. To ensure representation of young and Black women, eligible participants were sampled from four strata (sampling fractions in parentheses): Blacks under 50 years (100%), Blacks 50 years and older (60%), Whites under 50 years (40%), and Whites 50 years and older (15%) [12]. As such, 50% of CBCS-III consists of Black women, of whom approximately half are under 50. CBCS-III includes women residing in rural and urban settings, with private and/or public insurance (and uninsured), and those of varying income levels [12]. In-person surveys were administered to women within 9-months of diagnosis, and at a median of 5.2 months post-diagnosis (referred to as the “5-month survey” and ranging from 1.8-8.9 months) [12]. Surveys collected data on demographics, socioeconomic and HRQOL [12,19]. Twenty-five months post-diagnosis women completed a follow-up mail-in survey, which included HRQOL questionnaires. Participants completed informed consent, including permission for researchers to abstract medical records [12,19]. This study was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill.

### Participants

As the study was interested in changes in HRQOL between active treatment and survivorship (in terms of diagnosis and primary treatment), the cohort was restricted to women who completed both 5-and 25-month surveys. Furthermore, as the focus of this study was in Black-White differences in HRQOL, only Non-Hispanic Black and White women were included. Of the 2,998 women who completed a 5-month survey, 2,561 (85%) completed a 25-month survey. Additionally, 97 (4%) women were excluded because they identified as “other race” or Hispanic. Women with distant stage BC represented less than 3% of the cohort and were excluded to ensure tumor and treatment homogeneity. The final cohort included 2,142 women.

### Outcomes

HRQOL instruments included the Functional Assessment of Cancer Therapy for BC (FACT-B) and the Functional Assessment of Chronic Illness Therapy for Spiritual Well-Being (FACIT-SP). The FACT-B includes 5 domains: Physical Well-Being, Social Well-Being, Emotional Well-Being, Functional Well-Being, and BC-specific Concerns [20]. The FACT-B has been validated and shown to be responsive among women with BC [20]. Minimally important differences (MID) or smallest differences in HRQOL perceived as clinically meaningful are 2-points per domain [21].

The FACIT-SP is a validated chronic disease specific and includes the Spiritual Well-Being domain [20]. The FACIT-SP is the most commonly used instrument to measure spiritual well-being in cancer [22]. As with the FACT-B, higher scores indicate better HRQOL [20] [22].

## Independent Variable

Self-reported race (Non-Hispanic Black or White).

## Covariates

Demographic and lifestyle characteristics included age at diagnosis, smoking status, body mass index, and comorbid conditions (e.g., diabetes, chronic obstructive pulmonary disease, obesity, hypertension, and heart disease). Socioeconomics included marital status, education, family income, urban/rural residence, and insurance status at 5-months. Given a high degree of collinearity between socioeconomic factors ( $r > 0.80$ ), only education and insurance status were included in our models. Treatment covariates included surgery, radiation, chemotherapy, and Herceptin. Although we examined racial differences by tumor stage, size, grade, nodal status, and hormone receptor (HR) status, due to collinearity ( $r > 0.80$ ), we only controlled for tumor stage and HR status.

## Statistical analysis

We compared characteristics between Black and White women using t-tests for continuous covariates and chi-square tests for categorical variables. We tested differences in unadjusted mean HRQOL scores for FACT-B and FACIT-SP domains between Black and White women. We also compared physical, functional, social and emotional well-being domains [23]. Changes in HRQOL domains between 5- and 25-months were calculated as 5-month scores subtracted from 25-month scores. Positive changes show improvements and negative changes denote decrements.

Analysis of covariance (ANCOVA) models were used to examine predictors of HRQOL at 25-months, adjusting for 5-month scores, demographics, comorbidities, socioeconomics, treatment, and tumor characteristics. Each model's outcome was the 25-month HRQOL score. We ran one model per domain to isolate domain-specific predictors that may be masked by overall HRQOL score. Given a sample size of 2,142 women and significance level of 5%, we were powered at nearly 100% to detect minimally important differences (MIDs) for each domain. Analyses were performed in SAS 9.3 with two-sided statistical tests and a significance level of 5% for all analyses.

## Assessing Racial Disparities

We explored three approaches to assessing racial disparities to better understand if racial gaps in HRQOL existed and to identify potential mediators of HRQOL disparities. ANCOVA models controlling for race, treatment and tumor characteristics, but not socioeconomic factors were estimated. Differences in adjusted Least Square Means (LSMs) between Black and White women were tested for each domain. This was the study's primary approach and is consistent with the Institute of Medicine's (IOM) operationalization of racial disparities in health care, which conceptualizes race as a social construct linked to a range of mediating factors, including socioeconomic status [24]. The IOM considers a disparity as the difference in quality of care between two racial groups that cannot be explained by clinical differences, health status or patient preferences [25]. The motivation behind this approach is that minority groups are overrepresented in low socioeconomic groups; thus, including both race and socioeconomics in a model may underestimate racial differences

[24]. The following two approaches were implemented as sensitivity analyses to explore the extent to which racial differences were mediated by measurable socioeconomic factors.

ANCOVA models controlling for race and socioeconomic factors (and tumor and treatment characteristics) were estimated. Differences in adjusted LSMs between Blacks and Whites were tested. This approach is the residual direct effect (RDE) of race on health care, because it controls for all measurable mediators of the relationship between race and the outcome, thereby resulting in a “race” parameter estimate reflecting the unmediated effect of race on HRQOL [25] [26].

Models testing interaction terms between race and socioeconomic factors were estimated. This final approach treated race and socioeconomic status as distinct constructs which have independent and interactive effects on HRQOL [24]. That is, socioeconomic status is on the causal pathway between race and HRQOL and may moderate associations [27].

As additional sensitivity analyses, we ran race-stratified models to determine if race modified relationships between individual characteristics and HRQOL. An age-stratified model was also run to evaluate if disparities existed among women below or above age 40, which is the age at which women begin mammography screening. Finally, models stratifying women by menopausal status were estimated to determine if relationships between race and HRQOL varied.

## Results

### Participant characteristics

Table 1 presents race-stratified characteristics of the cohort. Age at diagnosis, surgery type, receipt of Herceptin, and prevalence of COPD and heart disease did not differ significantly between groups. Compared to Whites, Blacks were less likely to be married, have public insurance, and less education. Diabetes, obesity and hypertension were twice as common among Blacks. Blacks were more likely than Whites to be diagnosed with later stage BC and receive aggressive treatments such as chemotherapy and radiation.

### Unadjusted HRQOL

During active treatment (5-month survey), mean physical well-being scores were 1.2-3.7 points below U.S norm scores (Table 2) [23]. White women reported physical and functional well-being scores 2.5 and 1.9 points higher, respectively, than Blacks ( $p<0.0001$ ). Blacks reported spiritual well-being scores 2.1 points higher than Whites at 5-months ( $p<0.0001$ ).

During survivorship (25-month survey), Whites reported HRQOL scores above U.S norms across physical, social, emotional and functional well-being domains (Table 2, Figures 1-4) [23]. Blacks, however, reported physical well-being scores 1.2 points below U.S norms and 2.3 points below their White BC counterparts ( $p<0.0001$ ). Whites reported functional well-being scores 2.4 points higher on average than Blacks ( $p<0.0001$ ), exceeding MID thresholds. Black women reported spiritual well-being scores 2-points higher than Whites ( $p<0.0001$ ).

As women entered survivorship, MIDs of 2.3-2.5 points (improvements over time) were seen in physical well-being for Whites and Blacks. We did not observe meaningful changes for other domains (Table 2). On average, social well-being declined 1-point from 5- to 25-months for both groups, but was 1.7-3.0 points above U.S norms (Figure 2). From active treatment to survivorship, spiritual well-being declined 1-point for both groups while emotional well-being remained unchanged. On average, Black-White differences in HRQOL changes from 5- to 25-months ranged from 0.1-0.8 points. Differences between Blacks and White in functional well-being and BC-specific concerns changes from 5- to 25-months were statistically significant, but did not exceed MID thresholds.

### Adjusted HRQOL

In models adjusting for characteristics in Table 1, older age was significantly associated with better HRQOL at 25-months across all domains (Table 3). Being a smoker was associated with 1.2-1.9-point decreases in HRQOL across domains except for social well-being. Higher education was associated with the largest increase in physical and functional HRQOL. Obesity was significantly associated with decreases in BC-specific concerns.

### IOM

We observed statistically significant racial differences in physical, emotional, functional and spiritual well-being (Figure 5) during survivorship. Specifically, Whites had physical and functional well-being scores 0.5 ( $p<0.05$ ) and 1.0 ( $p<0.0001$ ) points higher, respectively, than Blacks. However, Blacks had emotional and spiritual well-being scores 0.5 ( $p<0.05$ ) and 0.8 ( $p<0.01$ ) points, respectively, higher than Whites. Differences were statistically significant, but none exceeded 2-point MID thresholds.

### RDE

Once socioeconomics were added to adjusted models, emotional, functional, and spiritual well-being domains remained significantly different between Black and White women (Figure 5) during survivorship. Black race was significantly associated with a 0.5-point ( $p<0.01$ ) increase in emotional well-being and a 1.2-point ( $p<0.01$ ) increase in spiritual well-being, while White race was associated with a 0.5-point ( $p<0.05$ ) increase in functional HRQOL. Although differences were statistically significant, none exceeded 2-point MID thresholds.

### Race and Socioeconomic Interactions

Interaction terms between race and socioeconomic factors were not statistically significant at the 0.05 level.

### Sensitivity Analyses

In race-stratified models, patient and treatment characteristics had similar associations with HRQOL in terms of estimates' direction, magnitude and significance for Blacks and Whites (results not shown). One notable difference was that among Black women, receipt of Herceptin was significantly associated with 0.8-1.2 point lower physical, emotional, functional and BC-specific concerns scores ( $p<0.01$ ), but this association was not seen



among Whites. White-Black Differences in HRQOL by age or menopausal status were not observed.

## Discussion

Domain-specific HRQOL patterns were examined to assess if Black and White women with BC are equally susceptible to poor HRQOL during active treatment and survivorship. Using the RDE approach, we found statistically significant, but not clinically meaningful Black-White differences in emotional and spiritual well-being at 25-months. Implementing the IOM approach, we again found small, but significant differences in physical, functional, emotional and spiritual well-being domains during survivorship. These findings are similar to other BC survivor studies that found racial differences in HRQOL following treatment were small and not clinically meaningful [28]. Previous work attributed racial differences in HRQOL to BC stage, treatments, comorbidities, and socioeconomics related to health care access [29].

Racial differences in physical and functional HRQOL appear to be mediated by socioeconomics. Race coefficients for physical and functional well-being domains attenuated by 50% once socioeconomics were controlled for, whereas emotional and social well-being coefficients remained unchanged. Gaps in spiritual well-being actually widened once socioeconomics were added to the model. Worse physical and functional HRQOL may be related to racial differences in access (e.g., financial barriers) to cancer care, which often emphasize management of physical and functional effects of cancer and its treatment [30]. Thus, racial differences in access to care are more likely to impact physical and functional well-being. Furthermore, physical and functional HRQOL may be impacted by comorbid conditions such as obesity, diabetes and hypertension, all of which were more prevalent in Black women in our study. A systematic review of BC survivors concluded that, in general, Black women report worse physical and functional well-being than their White counterparts, however, once demographic, socioeconomic and medical characteristics were adjusted for, physical and functional well-being differences between Black and White women attenuated, suggesting differences may be largely mediated by demographic and socioeconomic factors [31]. Socioeconomic-related barriers to physical and functional well-being must be addressed to help narrow gaps in these domains. Potential ways to improve physical and functional HRQOL could be to help manage other comorbidities and promote greater physical activity. Black women with BC tend to report lower levels of physical activity, which has been associated with poorer physical well-being and overall HRQOL [3,32]. Studies have also confirmed that although BC survivors report less physical activity compared to the general population, Whites with BC have higher levels of physical activity compared to Blacks, which may be facilitated by physical well-being and vitality [17,18,32].

Our findings are consistent with previous work concluding that women with BC report greater levels of social support compared to healthy women their age [33]. Increased social support among women with BC has been associated with better adjustment following primary BC treatments [30,34]. As such, it is not surprising that women in our study reported social well-being scores well above U.S norms during active treatment. Black women were less likely to be married, suggesting that their social support may have come

from sources other than partners (i.e., community, religious organizations) [30]. Previous studies also suggest Blacks experience positive growth following BC diagnosis and treatment, which may support social and emotional well-being [33,35].

Black women consistently report the importance of spirituality in coping with BC [18,36,37]. Spirituality has been described as a source of hope and comfort for Black women struggling with the psychosocial burden of BC diagnosis and treatment [35]. In fact, clinicians have been recommended to promote spirituality as a coping mechanism among Black women with BC, as it may mitigate effects of BC on psychosocial health [31] [35]. This is consistent with our findings that Blacks reported significantly higher levels of emotional and spiritual well-being than Whites, even after adjusting for patient characteristics.

Emotional and spiritual well-being were the only HRQOL domains not attenuated by socioeconomic factors. Racial differences in spiritual well-being actually widened after adjusting for socioeconomics. At first, it seems this suggests emotional and spiritual well-being domains may not be impacted by socioecological burden Black women more often endure [18]. Financial stressors, urban residence, job insecurity, and balancing multiple responsibilities (e.g., house, parental, job) make dealing with BC more difficult for Blacks [17,18,31]. Following diagnosis, Black women struggle with these challenges, exacerbating physical and functional well-being, which often decline following BC treatment [17,18]. This is in line with our observations that physical and functional HRQOL were lower among Blacks during active treatment. Emotional and spiritual well-being domains, however, appear more resistant to life stressors affecting other domains due to increased spirituality and community support. Another possibility is that BC and socioeconomic factors actually impact emotional and spiritual well-being, but in a way that reinforces these domains. The Superwoman role, a theory stating Black women feel they must exude strength, suppress emotions, and demonstrate perseverance when faced with adversity, may partially explain this [38]. If Black women do not allow themselves to acknowledge weakness or stress related to BC, self-reported emotional and spiritual well-being may not appear to suffer [38].

## Limitations

First, we only included Non-Hispanic Black and White women in North Carolina, limiting generalizability to women outside of the state and of other racial groups. As most women have initiated primary BC treatments by 5-months, there is no pre-treatment HRQOL measure. However, BC treatments (from medical records) were adjusted for in analyses. We were unable to control for unmeasured confounders such as patient preferences, culture, economic, political, and legal factors that may impact HRQOL.[27] As such, even in conservative models, race coefficients encompassed unmeasurable factors such as institutional racism, different care seeking behavior and access to health care networks that are not determined by insurance status, education and income, introducing potential bias.

## Conclusion

The richness of CBCS-III made it an ideal platform to understand racial disparities in HRQOL among women with BC in North Carolina. Statistically significant racial



differences in HRQOL changes (from active treatment to survivorship) were identified, but differences were not considered clinically meaningful. Results suggest socioeconomic factors may considerably mediate racial gaps in physical and functional HRQOL between White and Black women with BC. Supportive services should consider domain-specific findings to provide targeted HRQOL management across socio-demographic groups of women with BC.

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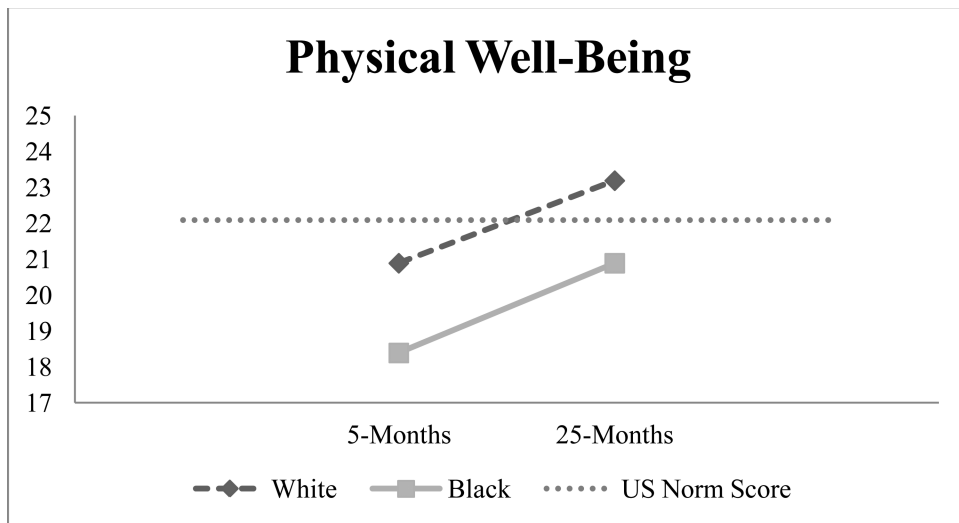
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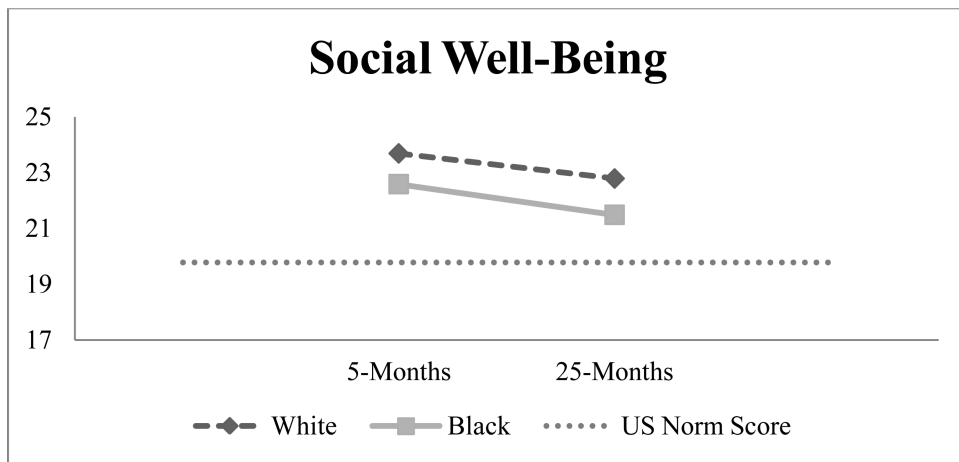
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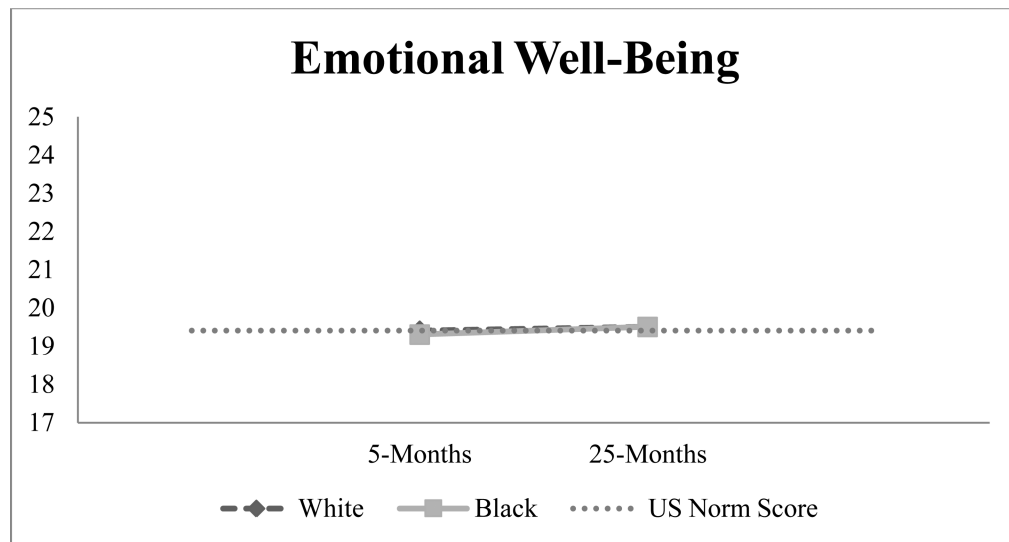
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**Figure 1.**  
HRQOL at 5- and 25-months by race with dotted line representing U.S norms

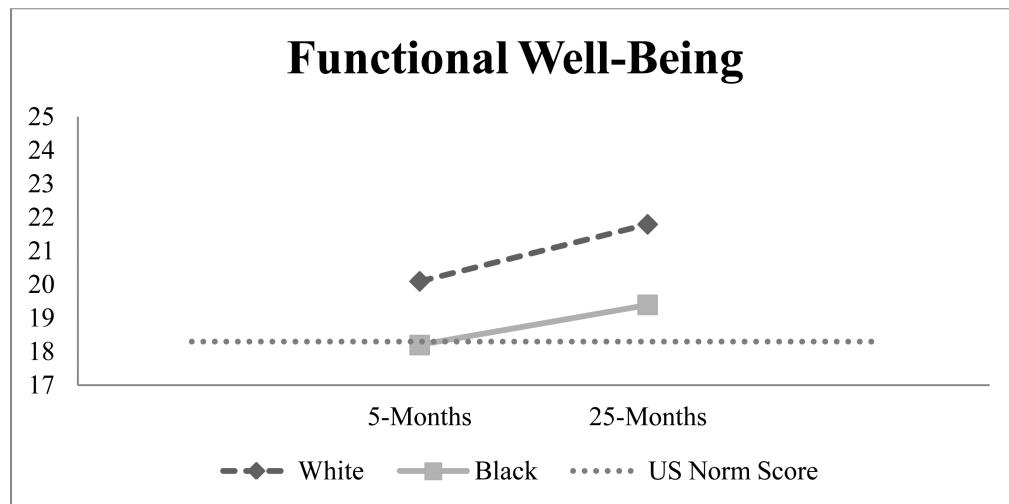


**Figure 2.**  
HRQOL at 5- and 25-months by race with dotted line representing U.S norms

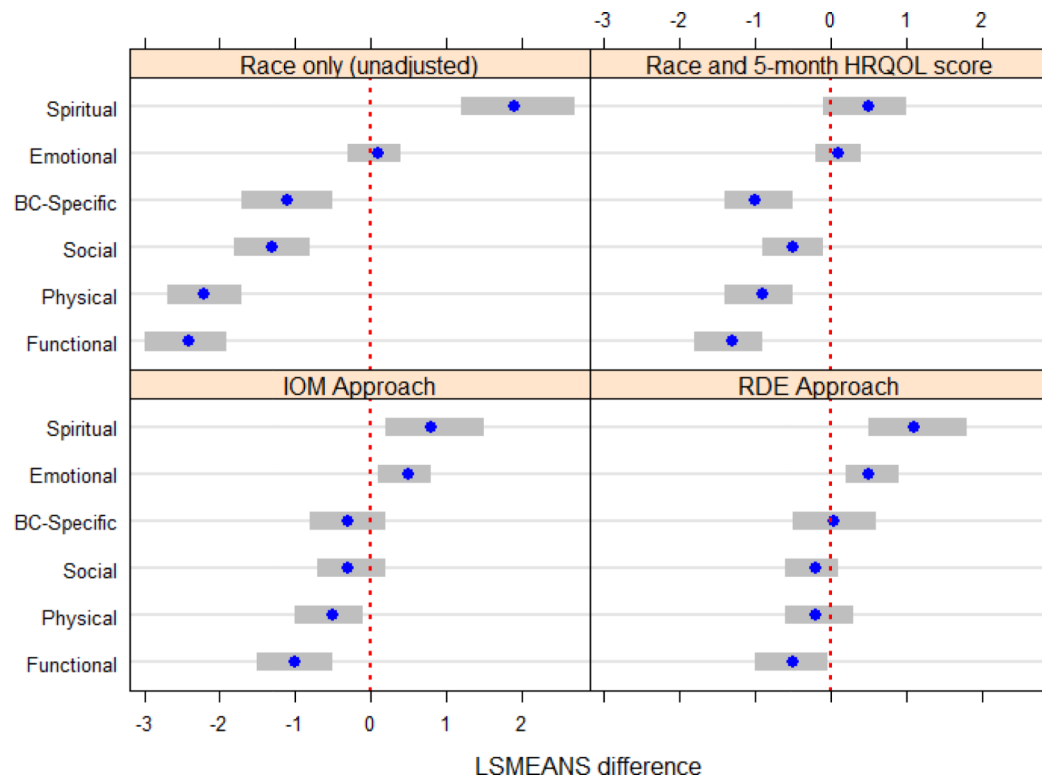


**Figure 3.**  
HRQOL at 5- and 25-months by race with dotted line representing U.S norms





**Figure 4.**  
HRQOL at 5- and 25-months by race with dotted line representing U.S norms



**Figure 5.**

Adjusted Least Square Mean Differences in 25-Month Scores by HRQOL Domain

Note: Blue dots represent adjusted LSM differences. Grey bars represent 95% confidence intervals. Differences calculated as White scores subtracted from Black scores. Negative differences indicate White women have higher HRQOL than Black women.

**Table 1****Cohort Characteristics by Race**

	Whites N=1,105		Blacks N=1,037		P-value
Demographics					
Age at diagnosis					0.1327
<35	39	4%	40	4%	
35-50	482	44%	440	42%	
50-64	363	33%	382	37%	
65+	221	20%	175	17%	
Smoking status					<0.0001***
Never	593	54%	607	59%	
Former	346	31%	231	22%	
Current	166	15%	199	19%	
Socioeconomics					
Married	802	73%	441	43%	<0.0001***
Education					<0.0001***
<High School	47	4%	119	11%	
Completed High School	514	47%	594	57%	
College+	544	49%	324	31%	
Insurance status					<0.0001***
None	30	3%	78	8%	
Private	917	83%	618	60%	
Public	158	14%	341	33%	
Comorbidities					
Diabetes	91	8%	231	22%	<0.0001***
COPD	29	3%	24	2%	0.6443
Heart Disease	51	5%	55	5%	0.4629
Obesity	100	9%	190	18%	<0.0001***
Hypertension	350	32%	619	60%	<0.0001***
Treatments					
Surgery					0.2337
Not specified	11	1%	6	<1%	
Lumpectomy	709	63%	696	66%	
Mastectomy	385	34%	335	32%	
Chemotherapy	627	57%	709	68%	<0.0001***
Radiation	785	71%	785	76%	0.0149*
Herceptin	143	13%	165	16%	0.0502
Tumor characteristics					
Stage					<0.0001***
I	570	52%	416	40%	
II	416	38%	466	45%	
III	119	11%	155	15%	

	<b>Whites N=1,105</b>		<b>Blacks N=1,037</b>		<b>P-value</b>
Hormone Receptor Status					<0.0001***
Positive/Borderline	909	81%	690	65%	
Negative	196	18%	347	33%	

p<0.05 \*, p<0.01 \*\*, p<0.0001\*

**Table 2**

Unadjusted HRQOL Scores by Race and U.S Norms [23]

	U.S Norms	5-Month Scores		25-Month Scores		5 to 25-month Changes	
		White	Black	White	Black	White	Black
Physical	22.1 (5.4)	20.9 (6.0)	18.4 (6.8)	23.2 (5.3)	20.9 (6.3)	2.3	2.5
Social	19.8 (6.8)	23.7 (4.5)	22.6 (5.1)	22.8 (5.3)	21.5 (6.2)	−0.9	−1.1
Emotional	19.4 (5.1)	19.4 (3.7)	19.3 (4.5)	19.5 (3.9)	19.5 (4.6)	0.1	0.2
Functional	18.3(6.9)	20.1 (5.8)	18.2 (6.7)	21.8 (5.6)	19.4 (7.0)	1.7	1.2
BC-Specific	N/A	23.9 (6.1)	23.6 (6.9)	25.0 (6.3)	23.9 (7.5)	1.1	0.3
Spiritual	N/A	39.3 (7.9)	41.4 (7.1)	38.5 (8.7)	40.5 (8.1)	−0.8	−0.9

Means (standard deviations). Change was calculated as 5-month scores subtracted from 25-month scores.

**Table 3**

Analysis of Covariance Models By HRQOL Domain

	25-Month HRQOL					
	Physical	Social	Emotional	Functional	BC-Specific	Spiritual
5-Month HRQOL	0.46***	0.68***	0.54***	0.52***	0.58***	0.68***
<b>Demographics</b>						
Black race (ref=white)	-0.17	-0.18	0.54**	-0.52*	0.04	1.12**
Age at diagnosis	0.04**	0.03*	0.04***	0.03*	0.06***	0.04**
Smoking status (ref=never)						
Former	0.08	-0.27	-0.02	-0.21	-0.31	0.31
Current	-1.34**	-0.77*	-1.32***	-1.84***	-2.03***	-2.25***
<b>Socioeconomics</b>						
Marital status (ref=not married)	-0.08	-0.31	0.12	0.24	0.02	0.51
Education level (ref=<HS)						
HS & Post HS	0.76	0.85*	0.56	1.75***	0.39	0.36
College+	1.53**	0.77	0.63	1.95***	0.57	0.16
Insurance status (ref=private)						
Public	-1.55***	0.01	-0.43*	-1.65***	-1.35***	-0.69
Uninsured	-1.72**	-0.25	-0.01	-2.02***	-2.14***	-0.25
<b>Comorbid Conditions</b>						
Diabetes (ref=no)	-0.34	-0.48	-0.23	-0.33	0.52	0.34
COPD (ref=no)	-0.93	-0.59	-0.34	-1.45*	-0.91	-0.01
Heart Disease (ref=no)	-1.04*	-0.29	-0.88*	-1.22*	-0.51	-1.44*
Obesity (ref=no)	-0.90***	-0.05	-0.33*	-0.66**	-1.03***	-0.33
Hypertension (ref=no)	-0.11	-0.24	-0.25	-0.21	-0.25	-0.34
<b>Treatments</b>						
Surgery (ref=lumpectomy)						
Mastectomy	-0.29	-0.11	-0.07	-0.01	-0.56	-0.15
Not specified	0.36	0.15	1.41	0.65	-0.57	1.89
Chemotherapy (ref=none)	0.24	-0.13	0.03	0.65*	0.52	-0.08
Radiation (ref=none)	0.03	-0.03	-0.02	0.18	0.04	-0.12
Herceptin (ref=none)	-0.43	-0.11	-0.35	-0.51	-0.51	-0.35
<b>Tumor characteristics</b>						
Stage (ref=Stage I)						
II	-0.36	-0.23	-0.28	-0.31	-0.94**	-0.13
III	-0.15	0.04	-0.18	-0.15	-1.09*	-0.11
HR negative (ref=positive)	0.29	-0.31	0.21	0.27	-0.27	0.18

p&lt;0.05 \*, p&lt;0.01 \*\*, p&lt;0.0001\* 25-month HRQOL scores are adjusted for HRQOL at 5-months.